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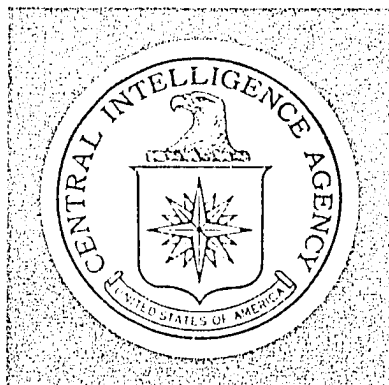
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DIRECTORATE OF
INTELLIGENCE

Intelligence Memorandum

POSSIBLE ALTERNATIVES TO THE ROLLING THUNDER PROGRAM

(The case in which the Rolling Thunder Program that existed prior to 31 March is modified to include attacks against inland water control facilities.)
(No. 4)

JCS review completed

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CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
July 1968

INTELLIGENCE MEMORANDUM

Possible Alternatives
to the Rolling Thunder Program

(The case in which the Rolling Thunder Program that existed prior to 31 March is modified to include attacks against inland water control facilities.) (No. 4)

Summary

Attacks against North Vietnam's dams and dikes, particularly the latter, could add appreciably to the adverse effects on North Vietnam of a resumption of the March 1968 Rolling Thunder Program, previously discussed in Question 10. A highly successful campaign could destroy as much as 25 percent of the annual rice crop. These water control facilities are not easily destroyed by air attacks, however, and the international reaction to the bombing of dams and dikes would be extremely unfavorable to the United States.

With one possible exception -- the 850-foot-long Dan Phuong Dam -- successful attacks against locks and dams would have little impact on North Vietnam's transport system or on Hanoi's war-supporting capabilities. A successful attack against the Dan Phuong Dam would cause serious flooding of valuable farmland southwest of Hanoi, but this dam would be extremely difficult to attack.

The most serious effects would result from a successful breaching of the elaborate system of

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dikes in the Red River Delta. In addition to its impact on rice crops, a successful breaching of the primary and secondary levees in the Hanoi area would produce the following short-term severe disruptions:

Most of the economic and military activity in Hanoi and its suburbs would be temporarily halted.

A number of significant military and industrial targets are located in potential flood areas. These include the Gia Lam and Bac Mai Airfields, the railroad yard and port facilities at Hanoi, and several major military barracks and storage areas and headquarters installations.

Key transport routes leading south and west from Hanoi, including Route 1A and the Hanoi-Vinh rail line, would be disrupted.

A sizable diversion of labor would be necessary for a period of weeks to repair flood damage.

The most significant results (and the most difficult to obtain) would be accomplished by a breaching of the levees during the high-water period between mid-July and mid-August. A successful attack at this time could produce losses from flooding of as much as one million tons of paddy rice. Hanoi would have to rely on external sources to replace these losses. The added import burden -- up to 2,500 tons of milled rice a day -- is well within the present estimated capabilities of the rail and road connections with Communist China.

The number of civilian casualties resulting from this campaign would be small, and, with continued aid from its allies, North Vietnam could soon adjust to the situation. Hanoi would, however, capitalize on opportunities presented by the attack to launch a heavy propaganda effort to put intense political pressure on the United States.

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Inland Waterways

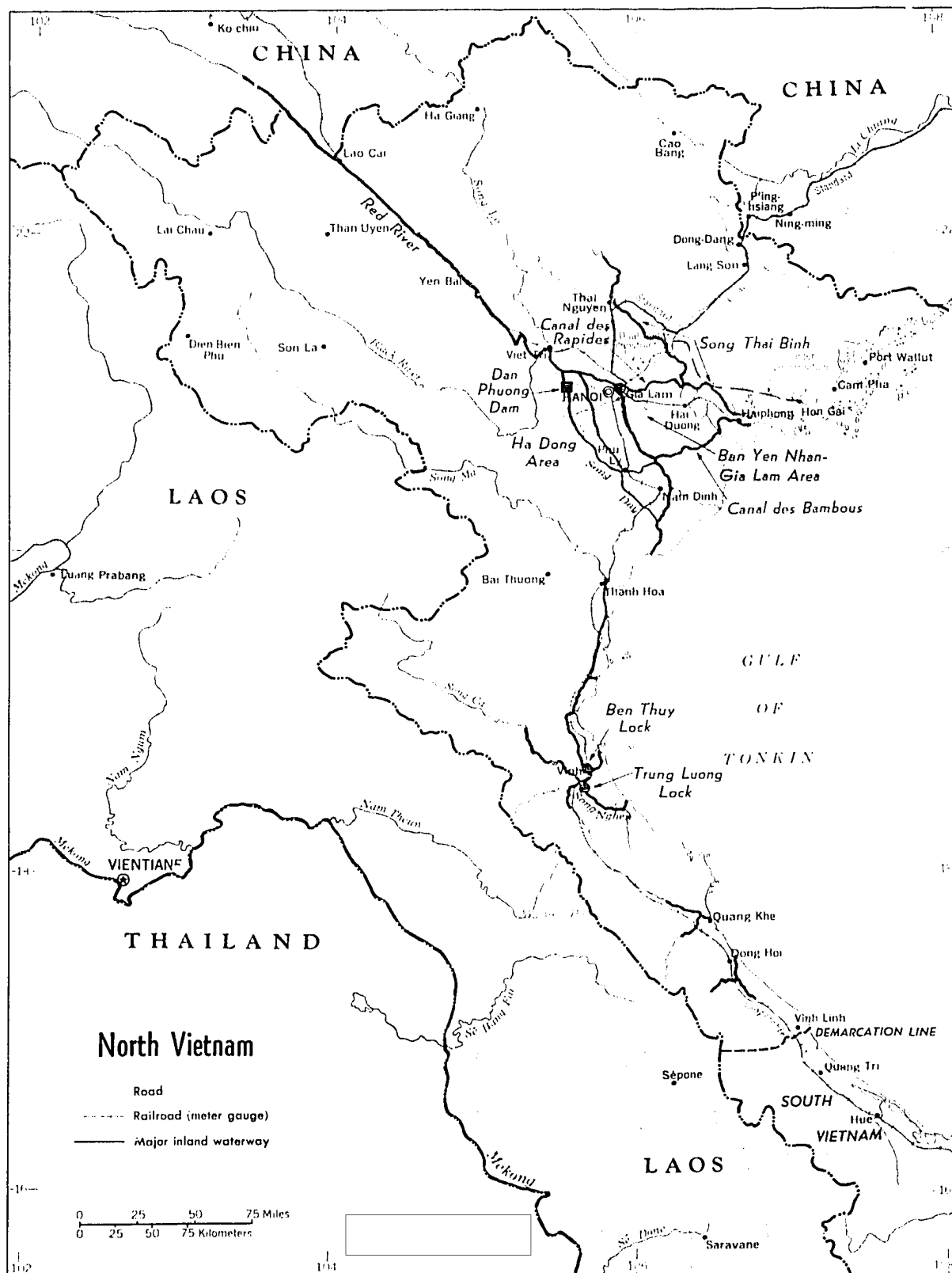
1. The Red River Delta contains the most important waterways of Vietnam -- the Red River, the Song Thai Binh River, and their two connecting waterways, the Canal des Rapides and the Canal des Bambous (see the map). These waterways connect the country's principal urban centers -- Hanoi, Haiphong, and Nam Dinh. Fertilizer, foodstuffs, petroleum, and other imports are moved from Haiphong in part by inland waterways, as is the coal mined in the Hon Gai and Cam Pha areas. Since the Rolling Thunder Program was inaugurated, an increasing number of water craft have been used to distribute POL directly from ocean tankers to dispersed storage and transshipment sites along Delta waterways and to aid in moving material from the port of Haiphong. Most of North Vietnam's farmland is in the Delta; it is dependent on irrigation during the dry months and is endangered by flooding in the wet months. Furthermore, much of North Vietnam's urban areas in the Delta are below the wet-season crests of these Delta rivers.

2. The Panhandle region of southern North Vietnam also contains navigable waterways, but they are less important than the waterways in the Delta. The most important inland waterway south of the 20th Parallel is the waterway between Thanh Hoa and Vinh. There are no through inland water routes from North Vietnam into Laos or South Vietnam. However, infiltration movements southward are facilitated by short overwater hauls and the extensive transshipment capability of the waterway system. For example, supplies shipped to Vinh via rail and highway are frequently ferried across the Song Ca River or moved in watercraft on short-distance hauls toward Mu Gia or south toward the DMZ. Other areas of watercraft activity and transshipment are at Ha Tinh, Quang Khe, and Dong Hoi. Waterways in the Panhandle also support small agricultural communities near Thanh Hoa and Vinh.

Locks

3. The Song Thai Binh River is the only major waterway in the Red River Delta that has navigation locks to control water levels and facilitate

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transport along otherwise unnavigable stretches. These locks control water traffic to Thai Nguyen. Currently, water transport to Thai Nguyen is of little importance because bomb damage to the area's industry has sharply reduced transport requirements. A number of secondary waterways in the Delta have navigation locks, but these waterways do not handle significant amounts of traffic for urban centers.

4. In the Panhandle, a large number of small locks are found in and around Thanh Hoa and Vinh, but only a few of these locks have significance for waterway transport. The Ben Thuy Lock connects the main north-south inland waterway in this region with the Song Ca River at Vinh. The Trung Luong Lock on the Song Nghen River connects Vinh with Ha Tinh.

5. Because of their low profile and strong construction, locks are not vulnerable targets. Most of the locks consist of a single basin formed by earth slopes faced on the water side with loose stone or other masonry. Bulkheads containing steel or wood entrance gates at the end of the basins are usually made of reinforced concrete backed by earth fill. The most vulnerable parts of the locks are the gates. They can be destroyed or rendered inoperative by a small bomb, but a direct hit would probably be required. Severe damage to locks probably could be repaired within six months.

6. Successful attacks against North Vietnam's locks would have little impact on North Vietnam's transport system. Inland watercraft could be diverted to waterways not dependent on locks. Cargoes intended for water transport could be sent by the many alternative rail or highway routes that parallel the inland water network. Because of accidental bomb damage, the Ben Thuy Lock and two of the eight JCS-targeted locks are not now being used, yet water transport in the vicinity of the damaged locks seems to be unaffected.

Dams

7. Dams to control flooding and irrigation are located throughout North Vietnam, primarily in the Red River Delta. Some of these dams could be breached by a small number of hits during

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periods of high water, when current velocities are greatest and the high water creates maximum pressure. The prospects for causing significant flood damage or disruption of water transport are limited. Most of the dams are small; they are made of packed earth, are less than 60 feet long, and are less than 10 feet high. The few larger dams are constructed of concrete and often have gates to permit through navigation of watercraft. Earthen dams can be repaired quickly with primitive materials and almost no construction machinery. A significant exception to North Vietnam's small and unimportant dams is the 850-foot-long Dan Phuong Dam near the junction of the Red and Song Day Rivers that protects valuable farmland southwest of Hanoi from flooding. The dam is a low, massive concrete structure, however, that would not be very susceptible to air attack.

Dikes

8. Dikes to control flooding and the course of the waterways are located along all of North Vietnam's major rivers, but they are most important and most fully developed along the Red River. The Red River dike system begins near Viet Tri, which is only 43 feet above sea level although about 100 miles inland at the northwest head of the Delta. From that point the river falls an average of 6 inches per mile to the sea. The great amount of silt brought down from the mountains and deposited along the river beds in the Red River Delta has raised the waterways above the surrounding countryside in many places and required the constant elevation of the restraining walls. In some areas, particularly around Hanoi, the height of the dikes reaches 40 feet. The primary system of dikes is backed up by a secondary system, between 4 and 22 feet high, that runs parallel to the main dikes. This secondary system is designed to localize and minimize damage if the primary dikes are breached. A tertiary system of smaller dikes has also been built to divide the rice-growing plains into compartments and to assist irrigation. These latter dikes also control the level of small streams and local waterways. In addition, the river dike system is complemented by small natural or manmade dikes along the coast which keep out brackish seawater.

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9. Dikes are particularly difficult to damage by air attack. Those in the primary system can be breached only by a series of overlapping craters across the entire top of a dike. The dikes along the right bank of the Red River have a width at the top of approximately 80 feet. Moreover, the lips of the bomb craters must be sufficiently lower than the surface of the river to initiate the flow and subsequent scouring action of water rushing through the breach. A destructive force equivalent to a train of eleven 1,000-pound general-purpose bombs, which would penetrate about 10 feet in average soil and produce craters 37 feet in diameter, would probably be needed to breach the Red River dikes. To achieve a 50-percent assurance of breaching a primary levee, five of these eleven-bomb trains would be required. Furthermore, simultaneous breaching at two or more points is desirable to disperse salvage operations and to obtain maximum flood damage. Additional strikes against the secondary dike system would be necessary to preclude these supporting dikes from absorbing the effects of the breaching of the primary levees.

10. Various countermeasures are available to the North Vietnamese even if the dikes are breached. Barges could be floated into the opening and sunk, creating the beginning of a temporary coffer dam. Once the flow of water through the gap was under control, the dike could be repaired quickly. In anticipation of attacks on the water system in 1965 and 1966, the North Vietnamese apparently collected barrage materials in the Hanoi area to fill breaches in the dikes, and this material is probably still available. Defensive breaching of the dikes upstream from a bomb breach could cushion the impact of the attack and could rapidly drop the level of flood water at Hanoi by as much as six feet. In this way, less important areas would be sacrificed to save urban or key agricultural regions. Dams and other water-control facilities along the major waterways could also divert much of a threatened river's volume. For example, an estimated 10 percent of the Red River's flood volume could be diverted into the Song Day River by the dam at Dan Phuong. This is more than the Song Day can handle, but the excess would be deposited on agricultural areas which are presumably less valuable than the urban areas around the capital.

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Flooding

11. The agricultural areas in North Vietnam most vulnerable to flooding are the Ha Dong area, a flat, densely populated rice-growing plain southwest of Hanoi lying between the Red River and the Song Day River, and the Gia Lam - Ban Yen Nhan area, a flat, rice-growing plain east of Hanoi, bordered by the Red River and Canal des Rapides (see the map). The Ha Dong area is a saucer-like plain only six feet above sea level at its lowest elevation. It is frequently inundated by heavy rainfall and probably could not be drained after flooding in less than a month. The Gia Lam - Ban Yen Nhan area, however, is high enough to be drained readily even during high water.

12. The principal impact of flooding resulting from air attacks against the dikes and dams would be on the rice crop -- the staple food in North Vietnam. If the dikes are breached between mid-July and mid-August, when the Red River is at its height, a substantial part of the tenth-month rice crop -- normally about two-thirds of the annual harvest -- would be completely destroyed by flooding, if the submersion of the rice plants persisted beyond two weeks. The rice plants are also vulnerable to shorter periods of submersion during mid-August after transplanting. A successful attack that managed to breach both the primary and secondary levees could cause crop losses from flooding of as much as one million tons of rice, or about 25 percent of North Vietnam's estimated 1967 production.

13. Hanoi would have to turn to outside sources to make up its rice losses. These amounts could be provided by North Vietnam's Communist allies, although they might be forced to procure offsetting amounts of grain in the Free World markets. The transport of these food supplies could be difficult, depending on the extent of damage to transport systems and the effectiveness of other interdiction programs. The losses could be replaced over a nine-month period during which the added import requirement would be a maximum of 2,500 tons of milled rice a day.* This increase in import traffic is well within the current capabilities of North Vietnam's rail and road transport connections to Communist China.

* This calculation is based on the assumption that 700,000 tons of milled rice would be imported.

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14. Most of the industrial, commercial, and military activity in Hanoi and its suburbs would be temporarily halted until the water receded. Included in the installations that would be affected are Gia Lam Airfield, the Hanoi Port Facilities, the Hanoi Railroad Yard, the Hanoi Engineering and Machine Tool Plant, the Hanoi Thermal Powerplant, and a number of recently constructed modern industrial facilities -- the Hanoi Rubber Products Plant, the Hanoi Soap Plant, the Hanoi Machinery Plant Gia Lam, and probably the 8th March Textile Plant. Military barracks, POL and material storage areas, air defense sites, and communications facilities would also be affected. To mitigate the effects of the flooding, Hanoi would be forced to divert an undetermined but very sizable work force away from other activities, including those of a military-supporting nature, for a period of weeks until the major damage had been repaired. Contingency measures devised from operating under the annual threat of floods, however, probably would minimize serious physical damage, and it seems likely that the flooding effects would be temporary.

15. In addition to halting economic and military activity in the Hanoi area and submerging valuable farmland, the destruction of dikes and dams would disrupt transport routes. The transport routes most vulnerable to flooding include the Hanoi-Vinh rail line, Route 1A between Hanoi and Phu Ly, Route 10 southwest of Haiphong, Route 11A west of Hanoi, and Routes 6 and 212 southwest of Hanoi. Some portions of Route 5 between Hanoi and Haiphong would probably also be affected.

16. The extent of destruction caused by flooding in the Panhandle would not be as widespread as in the Delta area. Land routes would probably become blocked at least temporarily at the major river crossings, hindering the southward movement of goods.

17. The breaching of the dikes in the Hanoi area would not necessarily result in a large number of casualties. JCS pre-strike estimates of the number of casualties resulting from the actual bombing attacks do not exceed 200. This number could be less in view of the population's experience in taking shelter from air attacks. The number of

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casualties resulting from flooding would also be limited because of North Vietnamese contingency planning and countermeasures and because the areas to be breached are areas in which flooding has been common; housing, for example, has been built to withstand high water levels.

Political Reactions

18. The principal effects of attacks on inland water control facilities would fall on the civilian population with only secondary effects on military targets. If the attacks successfully breached the levees and caused widespread flooding, world reaction would be highly unfavorable. The campaign would be viewed by most observers as an unconscionable escalation of the war. It would be extensively exploited in Hanoi's propaganda in order to put intense political pressure on the United States.